

WHAT IS CLAIMED IS:

1. A radiation substrate having a first surface and a second surface, both opposed to each other, and containing Al as a major component,

5 wherein a first metal film containing Cu, Ag, Sn, Ni, or Au as major material is formed as an uppermost layer on the first surface.

2. A radiation substrate according to claim 1,  
10 wherein the first metal film consists of a plating film.

3. A radiation substrate according to claim 2,  
wherein a metal body provided on a back surface of a  
semiconductor device is adhered by brazing solder, conductive  
15 paste, or adhering material having excellent thermal  
conductivity.

4. A radiation substrate according to claim 3,  
wherein the semiconductor device is mounted to be connected  
20 electrically to an electronic equipment, and the second  
surface is worked such that it can be connected to a constituent  
element made of metal in the electronic equipment via surface  
contact.

25 5. A semiconductor module comprising:

a semiconductor device in which a face up semiconductor element is sealed integrally by insulating resin and also pads connected electrically to bonding electrodes of the semiconductor element and an island positioned on a back surface of the semiconductor element are exposed from the back surface; and

a radiation substrate having a first surface and a second surface, both opposed to each other, and containing Al as a major component;

10 wherein a first metal film containing Cu, Ag, Sn, Ni, or Au as major material and formed by plating is formed as an uppermost layer on the first surface, and

the first metal film and the island are adhered together by brazing solder, conductive paste, or adhering material.

15 having excellent thermal conductivity.

6. A semiconductor module according to claim 5, wherein a metal film containing Cu as a major component is adhered between the first metal film and the island.

20

7. A semiconductor module according to claim 6, wherein the island and the metal plate are formed integrally by the etching process.

25 8. A semiconductor module according to claim 5,

wherein a back surface of the semiconductor element is adhered to the metal plate.

9. A semiconductor module according to claim 5,  
5 wherein back surfaces of the pads and a back surface of the island are arranged substantially on a same planar surface.

10. A semiconductor module according to claim 8,  
wherein back surfaces of the pads and a back surface of the  
10 semiconductor element are arranged substantially on a same planar surface.

11. A semiconductor module according to claim 9 or  
claim 10, wherein a back surface of the insulating resin  
15 is projected rather than back surfaces of the pads.

12. A semiconductor module according to claim 11,  
wherein side surfaces of the pads and a back surface of the  
insulating resin extended from the side surfaces of the pads  
20 draw a same curved surface.

13. A semiconductor module according to claim 12,  
wherein a flexible sheet having conductive patterns connected  
electrically to the semiconductor device is provided between  
25 the semiconductor device and the radiation substrate, and

an opening portion is provided in the flexible sheet to respond to the island.

14. A semiconductor module comprising:

5        a semiconductor device in which a face down semiconductor element is sealed integrally by insulating resin and also pads connected electrically to bonding electrodes of the semiconductor element and a radiation electrode positioned on a back surface of the semiconductor

10      element are exposed from the back surface; and

            a radiation substrate having a first surface and a second surface, both opposed to each other, and containing Al as a major component;

15      wherein a first metal film containing Cu, Ag, Sn, Ni, or Au as major material and formed by plating is formed as an uppermost layer on the first surface, and

            the first metal film and the radiation electrode are adhered together by brazing solder, conductive paste, or adhering material having excellent thermal conductivity.

20

15. A semiconductor module according to claim 14, wherein a metal film containing Cu as a major component is adhered between the first metal film and the radiation electrode.

25

16. A semiconductor module according to claim 14,  
wherein the radiation electrode and the metal plate are formed  
integrally by the etching process.

5 17. A semiconductor module according to claim 14,  
wherein back surfaces of the pads and a back surface of the  
radiation electrode are arranged substantially on a same  
planar surface.

10 18. A semiconductor module according to claim 17,  
wherein a back surface of the insulating resin is projected  
rather than back surfaces of the pads.

15 19. A semiconductor module according to claim 18,  
wherein side surfaces of the pads and a back surface of the  
insulating resin extended from the side surfaces of the pads  
draw a same curved surface.

20 20. A semiconductor module according to claim 19,  
wherein a flexible sheet having conductive patterns connected  
electrically to the semiconductor device is provided between  
the semiconductor device and the radiation substrate, and  
an opening portion is provided in the flexible sheet to respond  
to the radiation electrode.

21. A semiconductor module comprising:

a semiconductor device in which a face up semiconductor element is sealed integrally by insulating resin and also leads connected electrically to bonding electrodes of the  
5 semiconductor element and an island whose back surface is positioned on a same surface level as a back surface of the leads are exposed from the back surface; and

a radiation substrate having a first surface and a second surface, both opposed to each other, and containing Al as

10 a major component;

wherein a first metal film containing Cu, Ag, Sn, Ni, or Au as major material and formed by plating is formed as an uppermost layer on the first surface, and

15 the first metal film and the island are adhered together by brazing solder, conductive paste, or adhering material having excellent thermal conductivity.

22. A semiconductor module according to claim 21,

wherein a metal film containing Cu as a major component is  
20 adhered between the first metal film and the island.

23. A semiconductor module according to claim 22,

wherein a flexible sheet having conductive patterns connected electrically to the semiconductor device is provided between  
25 the semiconductor device and the radiation substrate, and

an opening portion is provided in the flexible sheet to respond to the island.

24. A semiconductor module according to claim 13,  
5 claim 20 or claim 23, wherein the semiconductor device is a read/write amplifier IC for a hard disk.

25. A semiconductor module according to claim 13,  
claim 20 or claim 23, wherein the semiconductor device is  
10 mounted to be connected electrically to an electronic equipment, and the second surface is worked such that it can be connected to a constituent element made of metal in the electronic equipment via surface contact.

15 26. A hard disk drive comprising a radiation substrate claimed in any one of claims 1 to 4.

27. A hard disk drive comprising a semiconductor module claimed in any one of claims 5 to 25.

20

28. A hard disk drive comprising:  
a recording disk;  
a spindle motor which rotates said recording disk;  
a magnetic head for writing and reading signals to and  
25 from said recording disk;

a suspension arm for supporting said magnetic head;  
an actuator for controlling a position of said magnetic  
disk;

an semiconductor module for processing said signals;

5 and

a casing for accommodating said recording disk, said  
spindlemotor, said suspension arm, and semiconductor module,  
wherein said semiconductor module comprising:

a semiconductor device in which a face up semiconductor

10 element is sealed integrally by insulating resin and also  
pads connected electrically to bonding electrodes of the  
semiconductor element and an island positioned on a back  
surface of the semiconductor element are exposed from the  
back surface; and

15 a radiation substrate having a first surface and a second  
surface, both opposed to each other, and containing Al as  
a major component;

wherein a first metal film containing Cu, Ag, Sn, Ni,  
or Au as major material and formed by plating is formed as  
20 an uppermost layer on the first surface, and

the first metal film and the island are adhered together  
by brazing solder, conductive paste, or adhering material  
having excellent thermal conductivity.

25 29. A hard disk drive comprising:

a recording disk;

a spindle motor which rotates said recording disk;

a magnetic head for writing and reading signals to and from said recording disk;

5        a suspension arm for supporting said magnetic head;

          an actuator for controlling a position of said magnetic disk;

          an semiconductor module for processing said signals;

          a casing for accommodating said recording disk, said

10      spindlemotor, saidsuspension arm, andsemiconductormodule; and

          a radiation substrate for radiating heat generated in the casing, said radiation substrate having a first surface and a second surface, both opposed to each other, and

15      containing Al as a major component,

          wherein a first metal film containing Cu, Ag, Sn, Ni, or Au as major material is formed as an uppermost layer on the first surface.